Michigan's Water Withdrawal Assessment Tool

Groundwater Protection: Science, Planning, and Action
GMAP, May 2011

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U.S. Department of the Interior
U.S. Geological Survey

Context for WWAT Design

- Assist Michigan in implementation of the Great Lakes-St. Lawrence River Basin Compact and Agreement
- Specifically—define and prohibit Adverse Resource Impacts (ARI) to water-dependent natural resources in streams
- Process designed to ensure proposed withdrawals are legal—with burden on proposer

USGS

Process vs Tool

- The WWAT is part of the Water Withdrawal Assessment Process
- Process includes all sources of water: Great Lakes, inland lakes, stream, groundwater
- Less than 100,000 GPD—not regulated
- Greater than 2,000,000 GPD—permit needed
- In between, registration, no permit, WWAT can be used for withdrawals that may affect streamflow
- Peer Review of Process

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WWAT

- WWAT is a screen to relieve the State of the need to evaluate all proposed withdrawals
- WWAT will indicate whether or not a proposed withdrawal may cause an ARI
- WWAT is available on-line
- Proposed withdrawals that do not pass thru screen must receive site-specific review and meet same criteria in WWAT
- Burden is on user to not cause ARI

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WWAT—Three Models

- **Flow—How much water is in the stream?**
- **Withdrawal—How much will a proposed withdrawal reduce streamflow?**
- **Fish—How will reduced streamflow affect fish?**

SAVE THE FLOW—The fishes are indicators of ecologically appropriate flows

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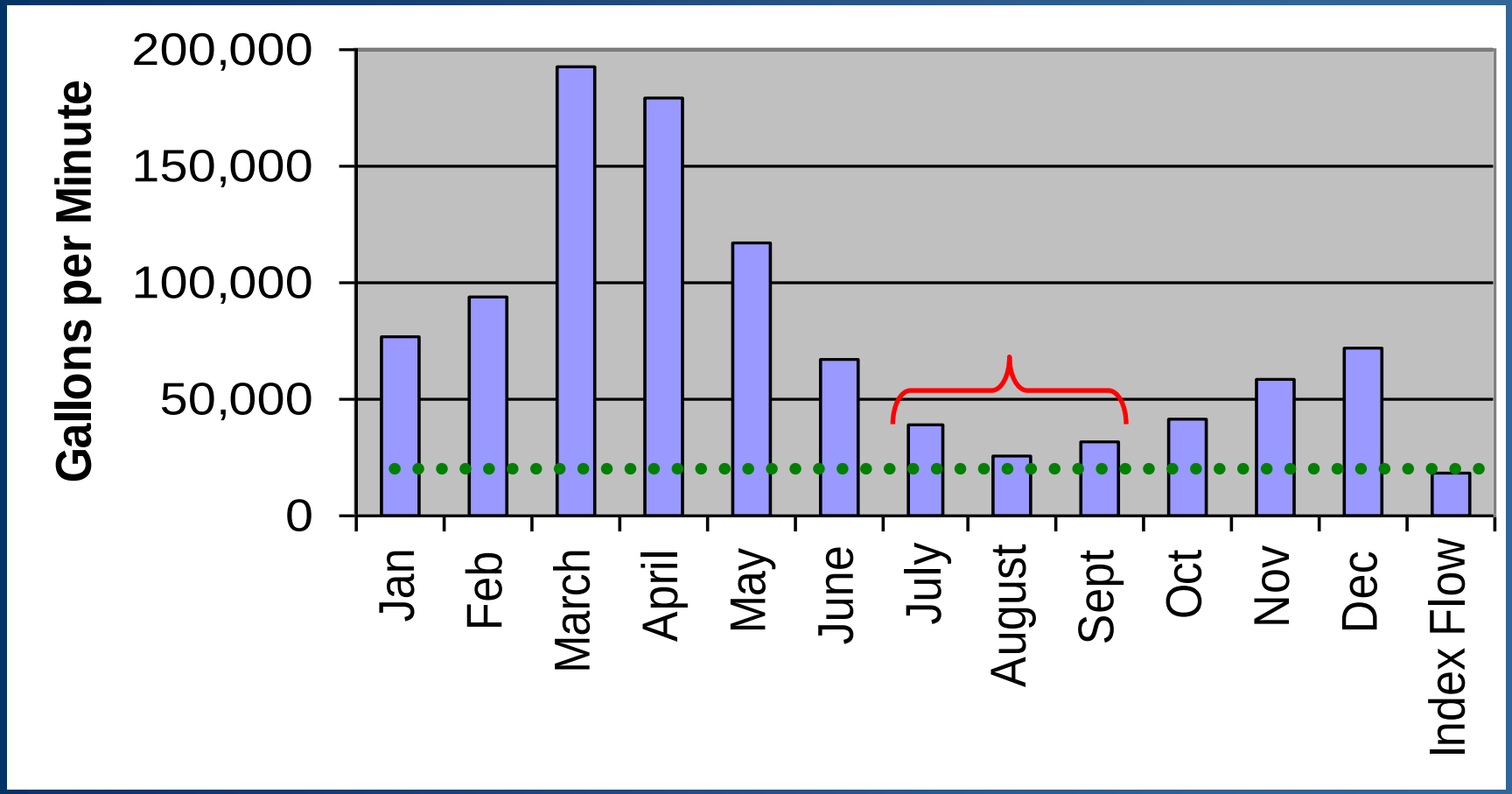
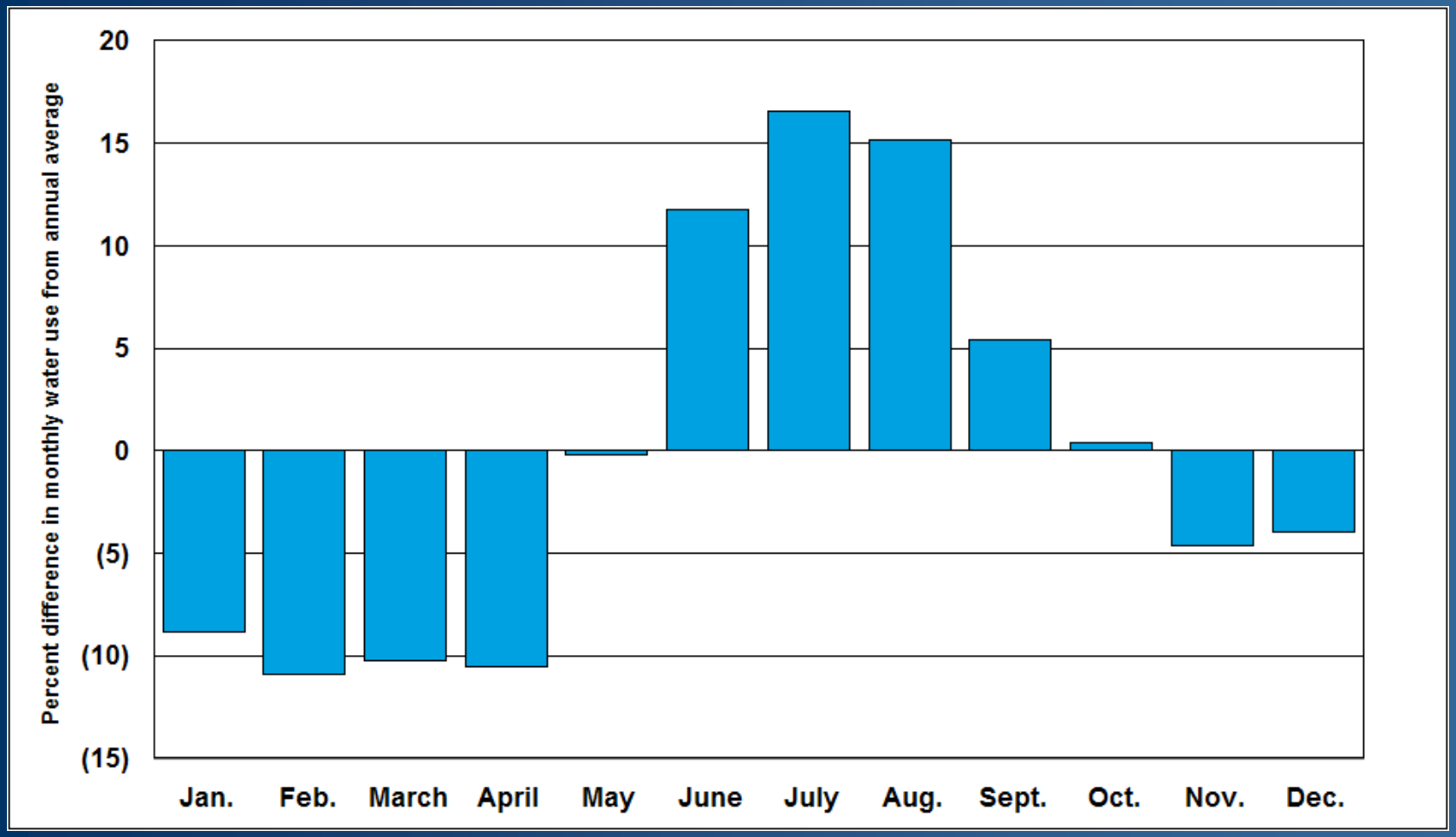
Flow Model

- Chose low summer flow as Index Flow
- WWAT uses half the Index Flow—safety
- Based on regression from USGS gages



Water Use in Ohio



USGS

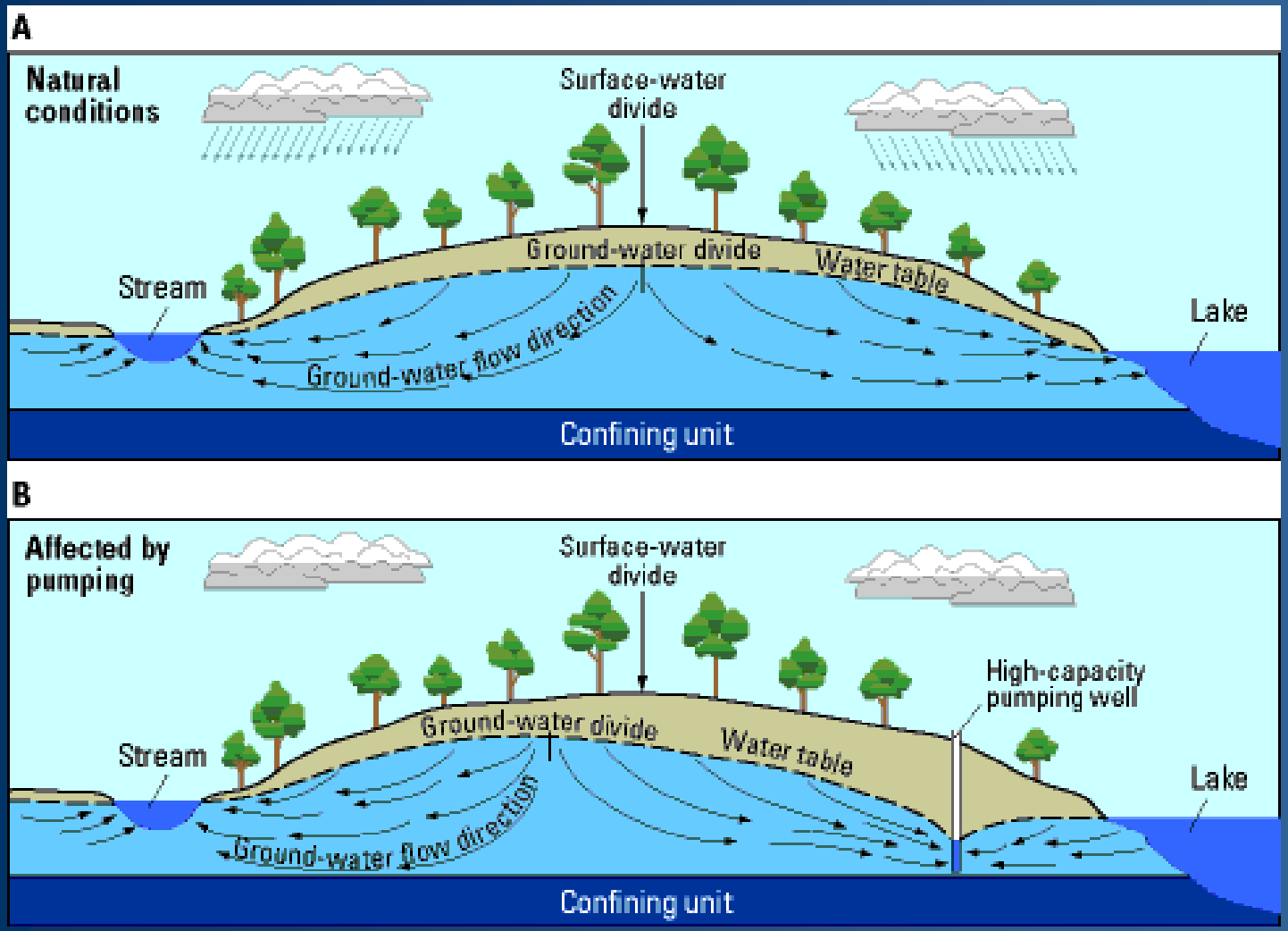
Compiled using data from Shaffer, 2009

Withdrawal Model

- From stream—100 percent removed from index flow
- From groundwater—May be less than 100 percent

USGS

Groundwater-Surface Water Interaction



USGS

Winter and others, 1998

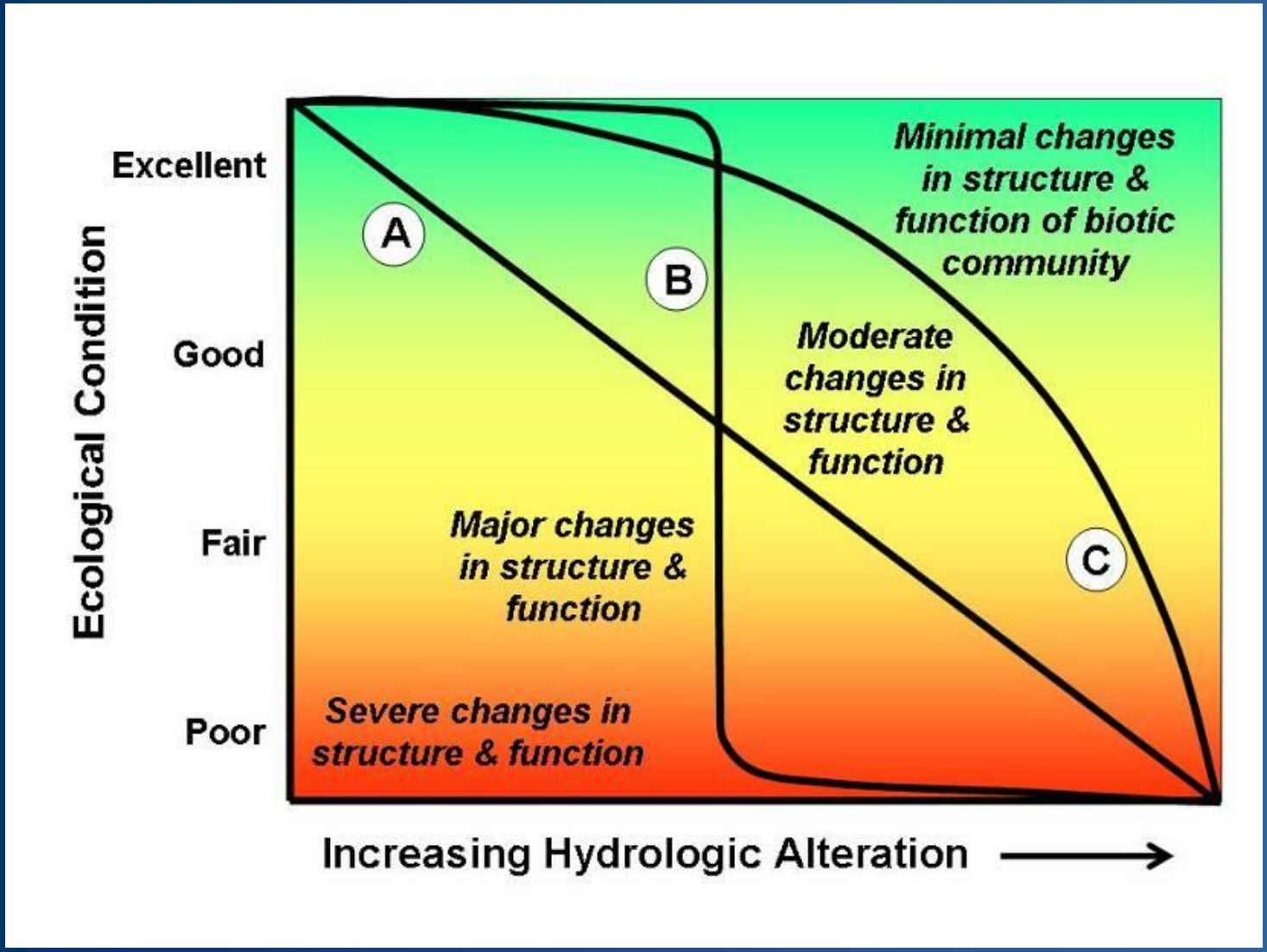
Withdrawal Model—Groundwater

- From groundwater—effect on stream depends on aquifer type, depth of well, distance from well, and pumping pattern
- Aquifer type based on GWIM
- Deeper wells affect more streams, but the effect is less on each
- Same for wells near watershed boundaries
- Intermittent well pumping may have less affect on stream than continuous pumping

USGS

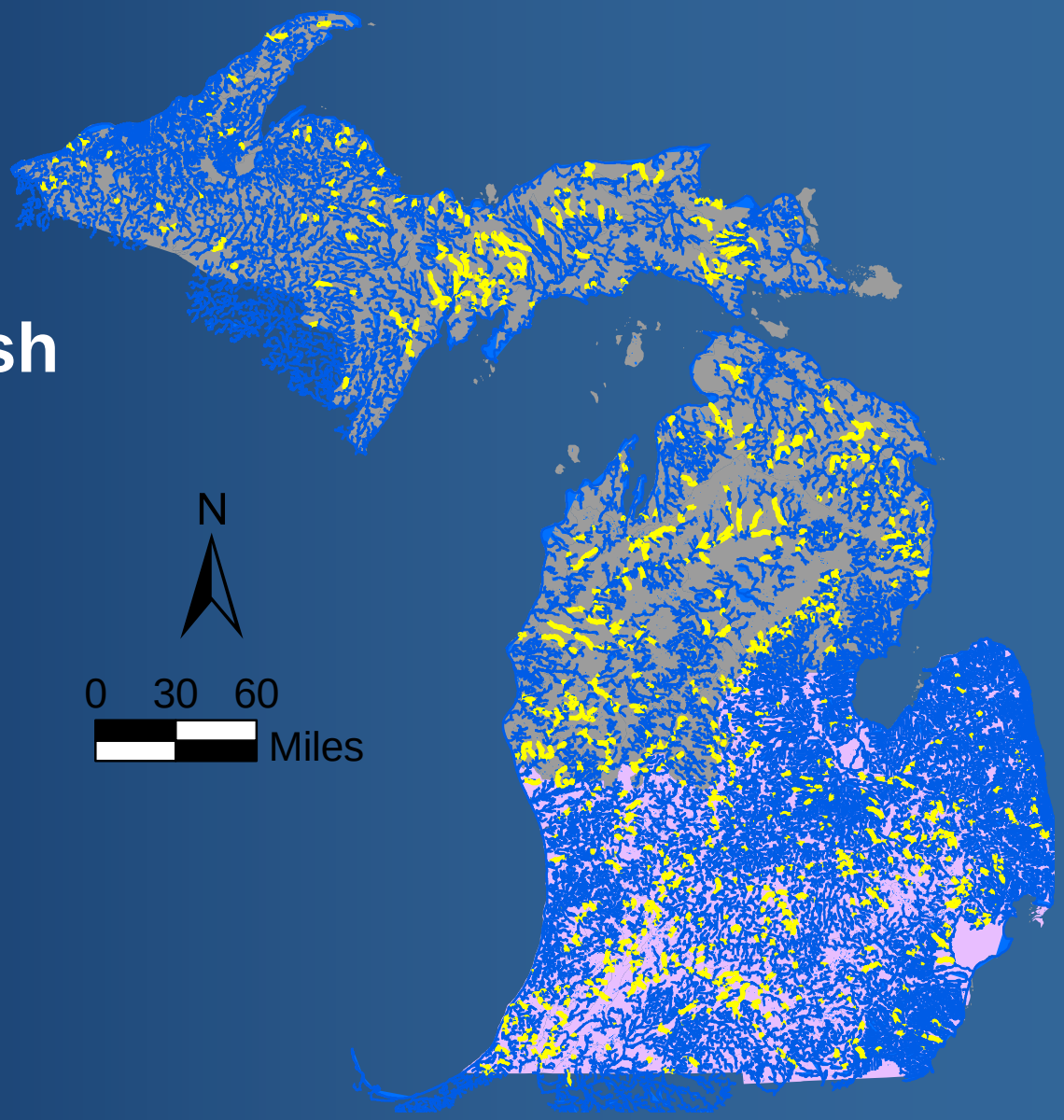
Fish Model

- **Response Curves predict how characteristic fishes will respond to changes in index flow**



Fish Surveys

1389 sites with fish assemblage data



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Stream Classification—Response Curves

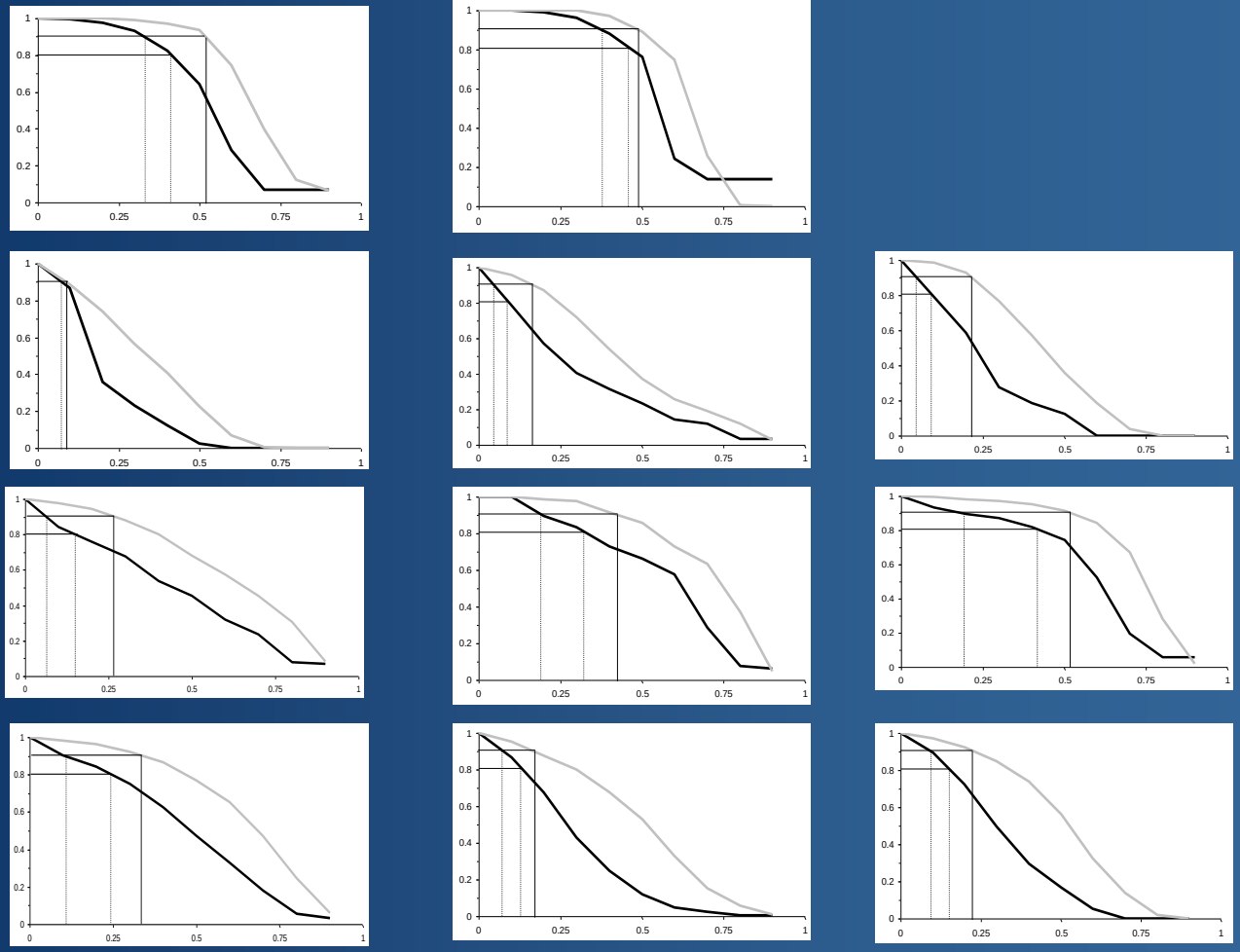
Proportion of initial fish population metric

Cold

Cold Trans.

Cool

Warm



Streams | Sm. Rivers | Lg. Rivers

Proportion of index flow removed

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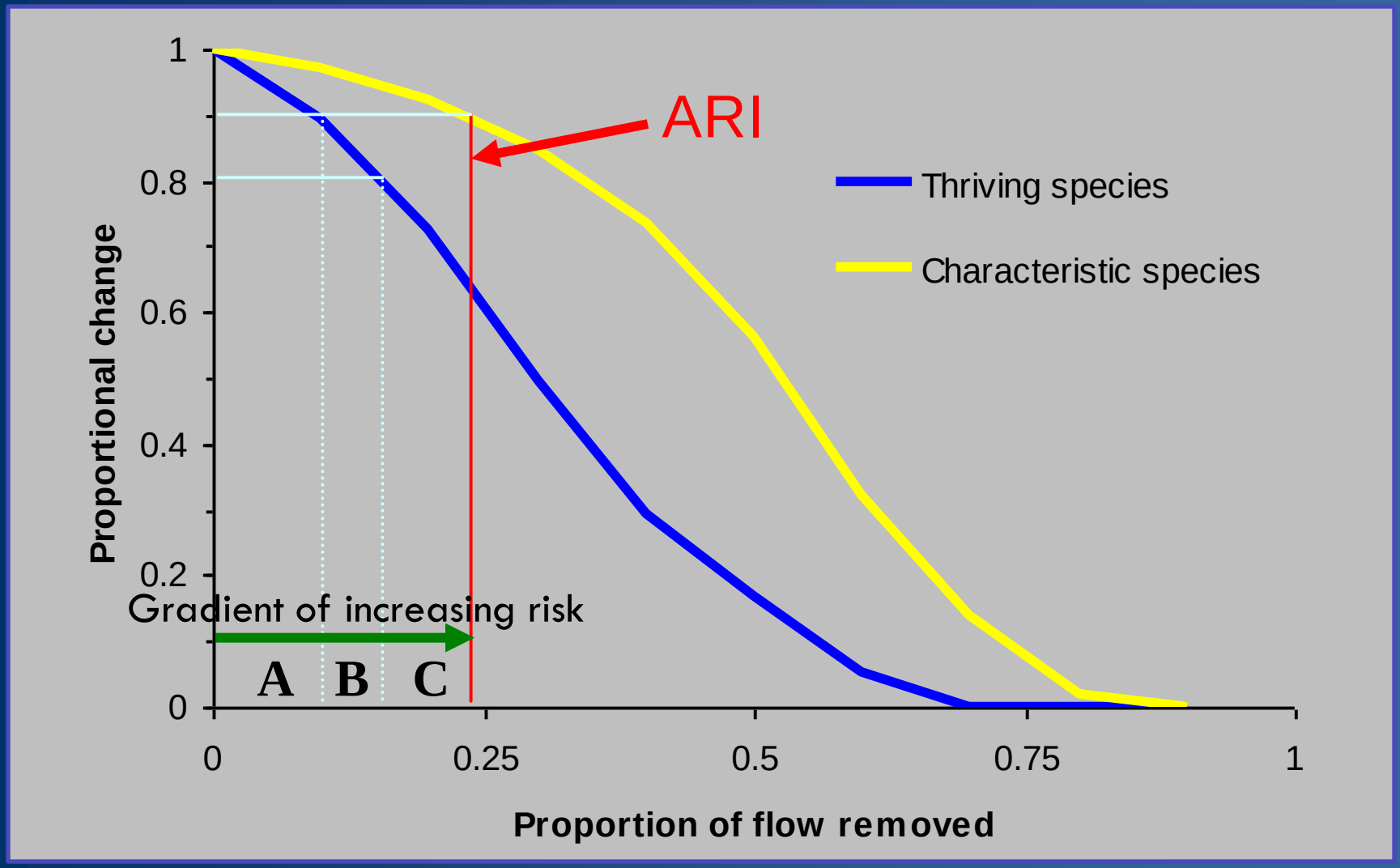
Response Curves—Gradient of Risk



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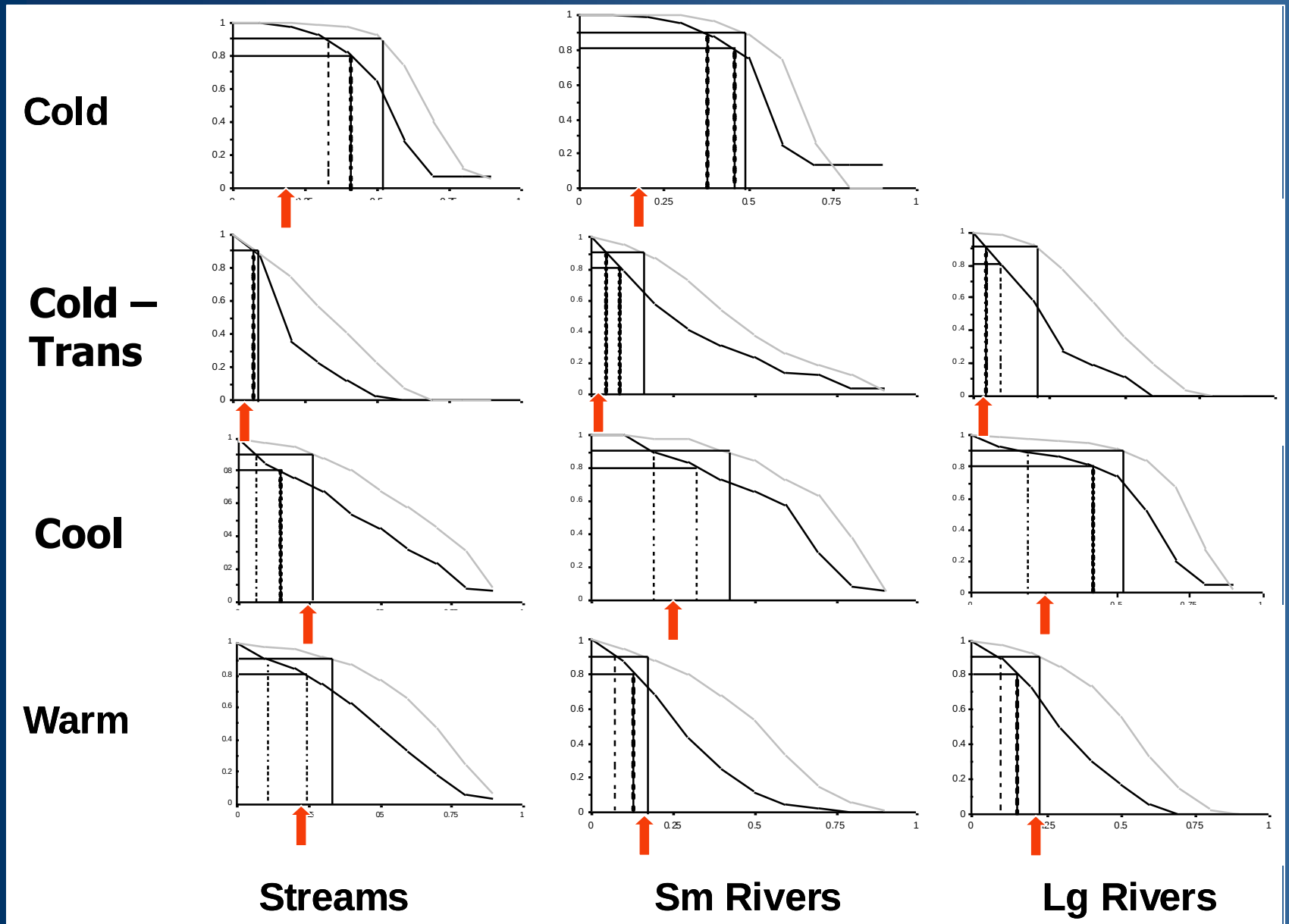
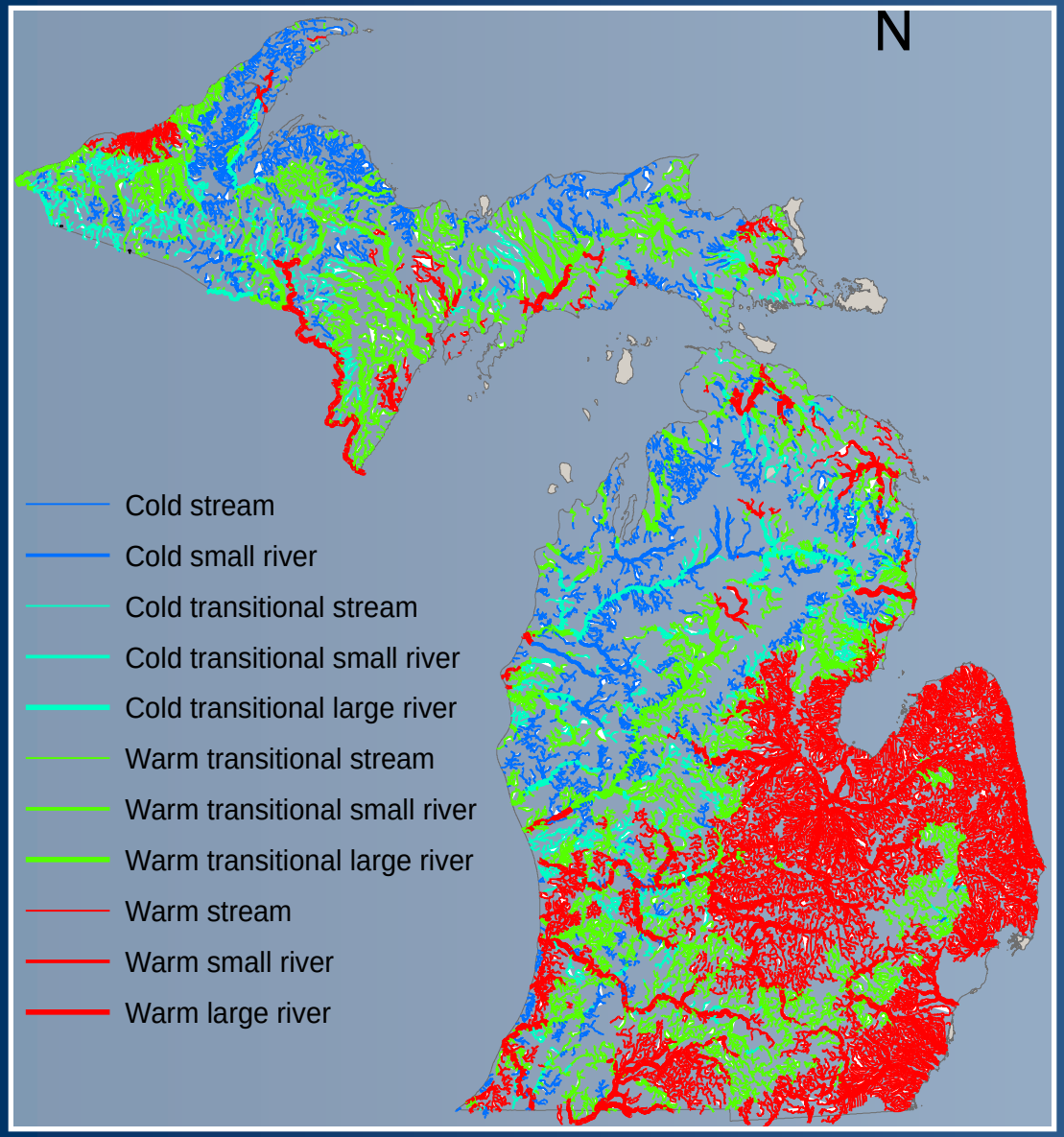
Proposed by Council

ARI Defined by Legislature





NHDPlus

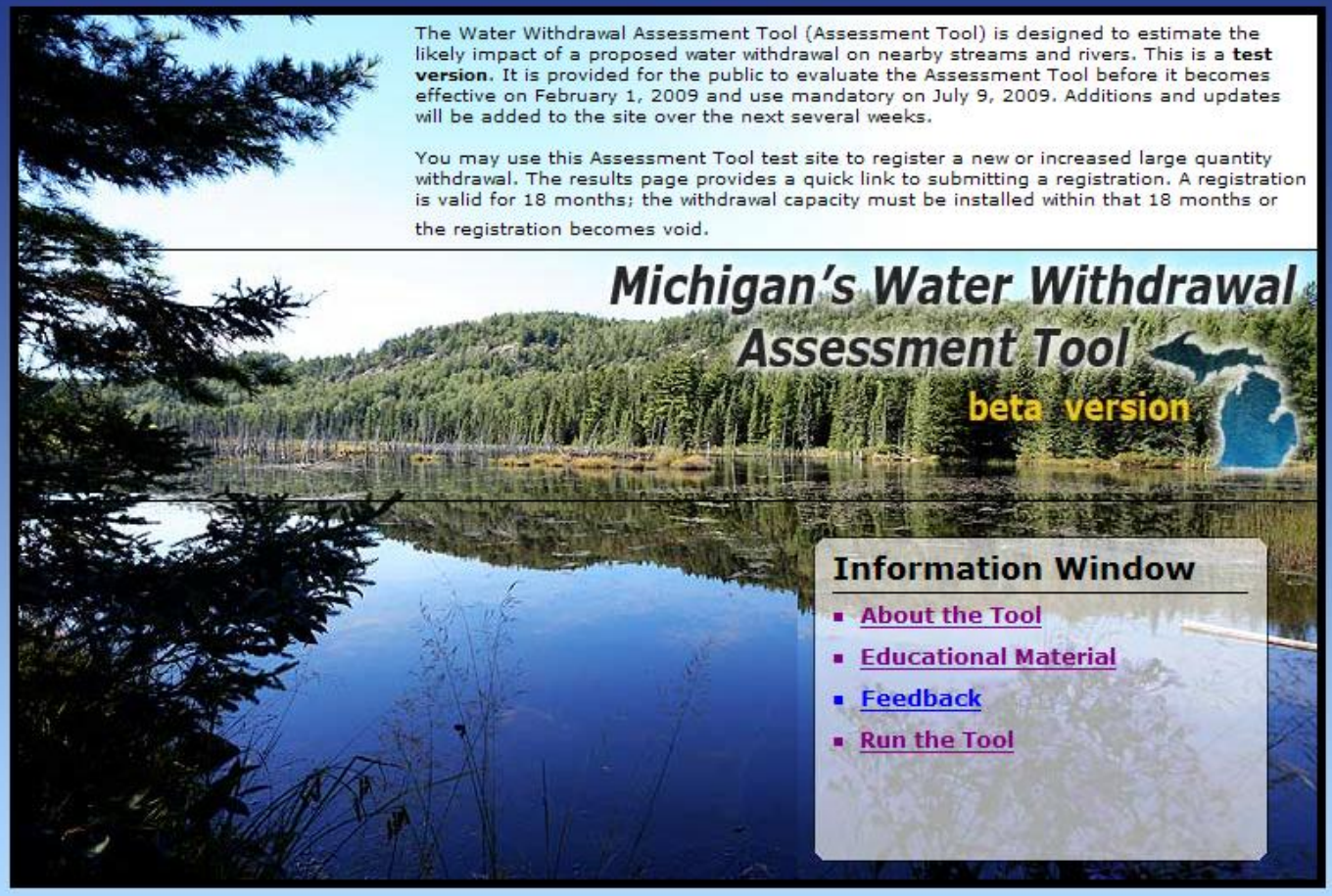
34,000 stream reaches in Michigan

Grouped into ~5300 valley segments

Each attributed with:

- **index flow**
- **aquifer type**
- **response curve based on stream type**

USGS


The Water Withdrawal Assessment Tool (Assessment Tool) is designed to estimate the likely impact of a proposed water withdrawal on nearby streams and rivers. This is a **test version**. It is provided for the public to evaluate the Assessment Tool before it becomes effective on February 1, 2009 and use mandatory on July 9, 2009. Additions and updates will be added to the site over the next several weeks.
You may use this Assessment Tool test site to register a new or increased large quantity withdrawal. The results page provides a quick link to submitting a registration. A registration is valid for 18 months; the withdrawal capacity must be installed within that 18 months or the registration becomes void.
Michigan's Water Withdrawal Assessment Tool
beta version
Information Window
About the Tool
Educational Material
Feedback
Run the Tool

WATER WITHDRAWAL ASSESSMENT TOOL

GIS Tools

Zoom In	Zoom Out
Address	Move Map
Back	Erase
Identify	Toggle Legend
Measure	Set Scale
Overview Map	Print
Query Builder	Help
New Withdrawal	

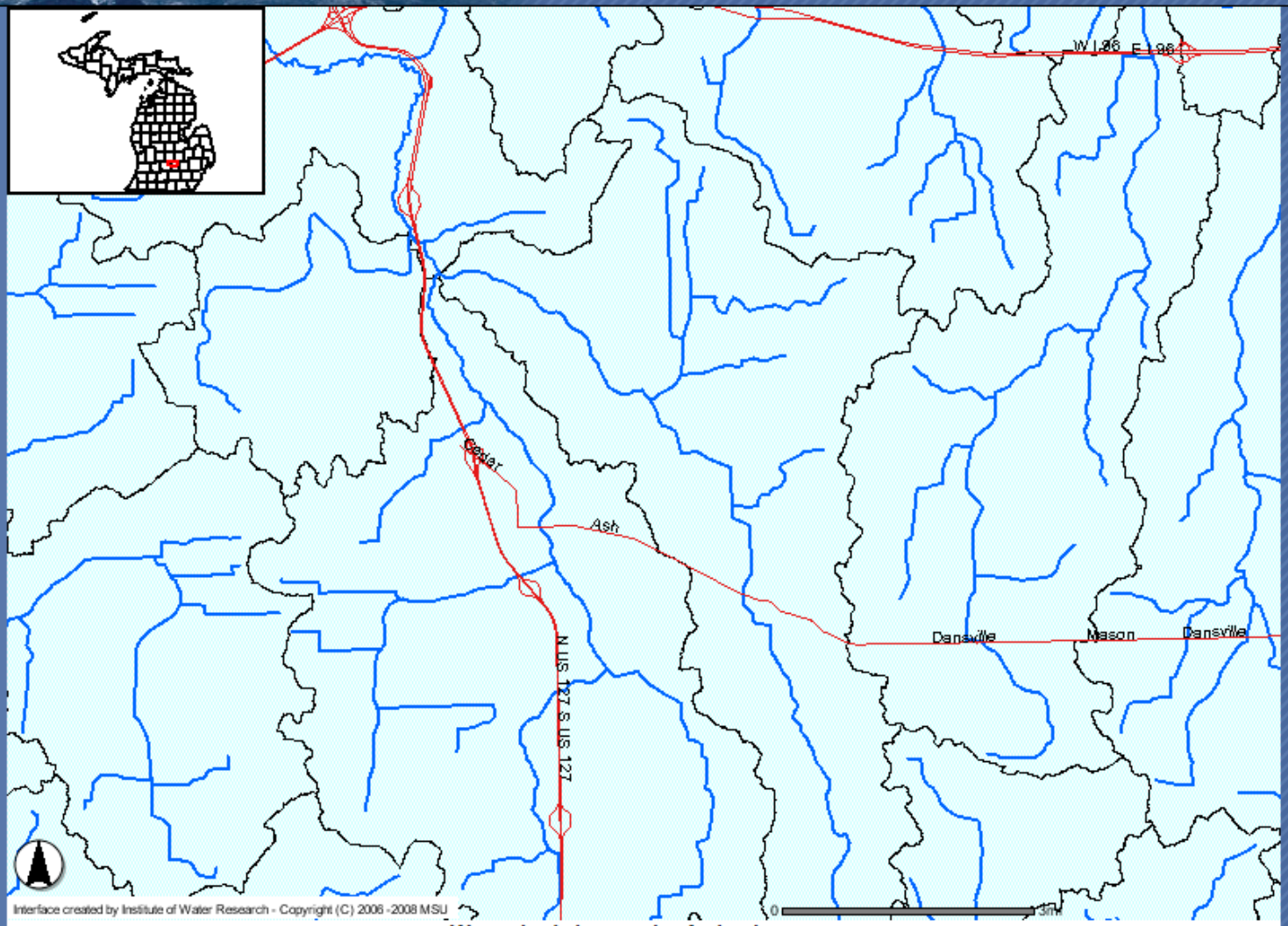
Data Layers

- All Layers
  - Roads
  - State Roads
  - Existing Wells
  - Streams
  - Lakes
  - Watersheds
  - Sections
  - County

Refresh Map

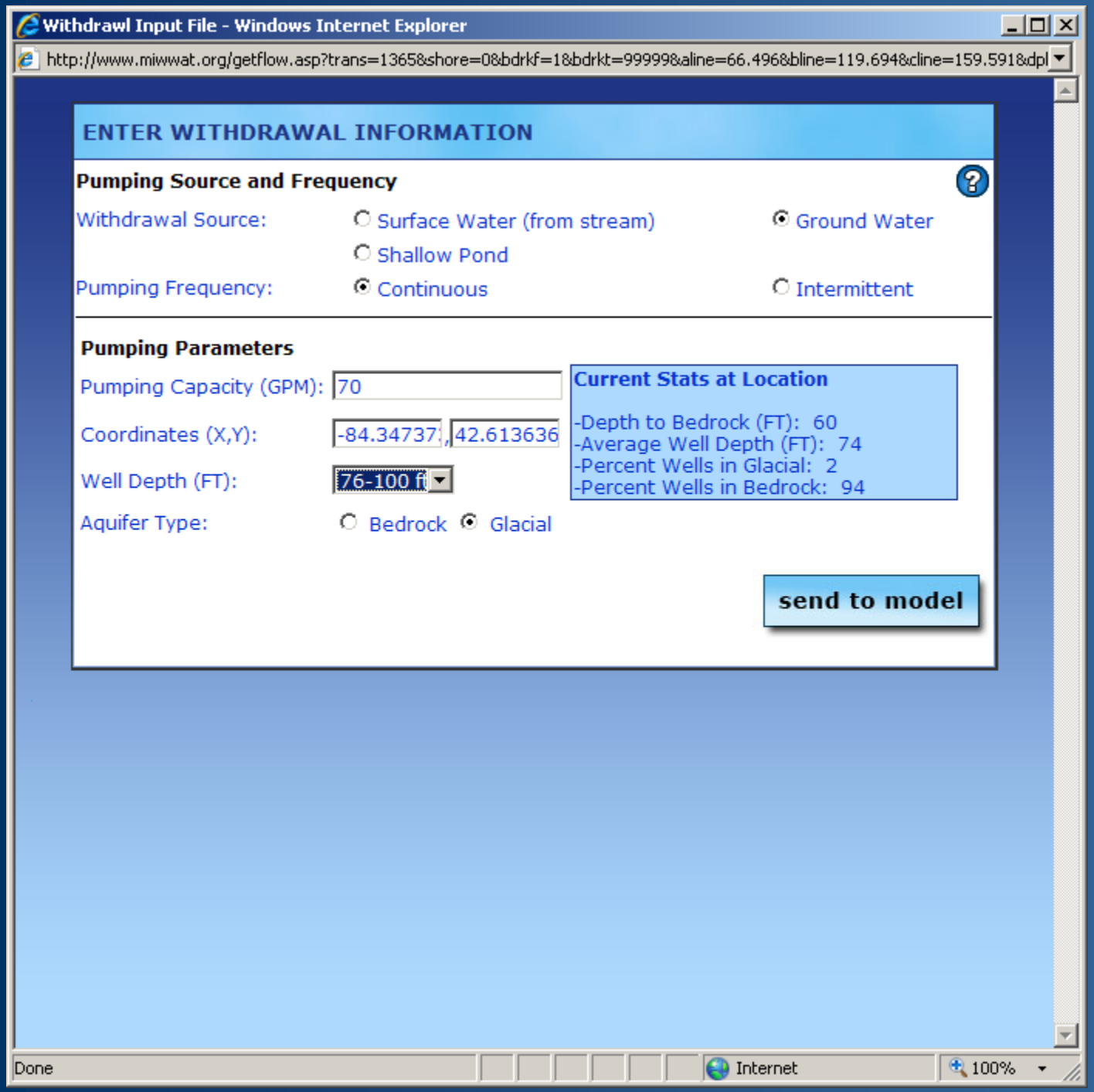
Auto Refresh

Data Layer Help?



Watersheds is now the Active Layer

Zoom In


Withdrawl Input File - Windows Internet Explorer
http://www.miwwat.org/getflow.asp?trans=1365&shore=0&bdrkf=1&bdrkt=99999&aline=66.496&bline=119.694&cline=159.591&dpl
ENTER WITHDRAWAL INFORMATION
Pumping Source and Frequency
Withdrawal Source:
Surface Water (from stream)
Ground Water
Shallow Pond
Pumping Frequency:
Continuous
Intermittent
Pumping Parameters
Pumping Capacity (GPM): 70
Coordinates (X,Y): -84.34737, 42.613636
Well Depth (FT): 76-100 ft
Aquifer Type:
Bedrock
Glacial
Current Stats at Location
-Depth to Bedrock (FT): 60
-Average Well Depth (FT): 74
-Percent Wells in Glacial: 2
-Percent Wells in Bedrock: 94
send to model
Done
Internet
100%

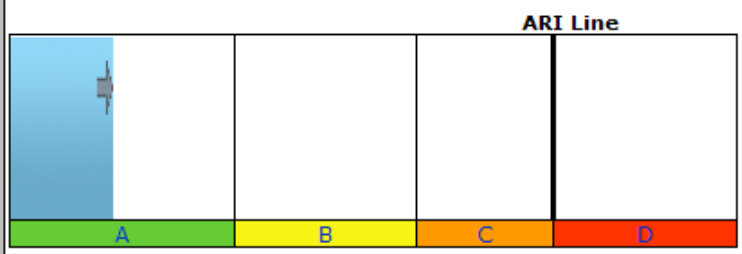
Screening Results - Windows Internet Explorer

http://www.miwwat.org/response.asp?count=6&id=20873,20733,20824,20872,21164,21327&estrm=30.6088576359904,1.4483633

Water Withdrawal Screening Results

WARNING: For evaluation purpose only.

Adverse Resource Impact (ARI) Graph



The ARI graph above illustrates the estimated removal of water from a nearby stream and its potential for causing an adverse resource impact (ARI).

The proposed withdrawal has passed in Zone A.

Screening Results - PASSED

STREAM CLASSIFICATION: Warm stream

TEST VERSION RESULTS:
The proposed withdrawal would pass the screening process. The projected impact of the withdrawal lies within 'Zone A' and would not likely cause an adverse resource impact under the zones that become effective on February 1, 2009.

REGISTRATION:
A Large quantity withdrawal (LQW) with a capacity of 70 gpm or greater must be registered with the Michigan Department of Environmental Quality or with the Michigan Department of Agriculture if the LQW is for an agricultural purpose, before the withdrawal can begin. A registration is valid for 18 months. The withdrawal capacity must be installed within this time period or the registration becomes void. Registration may be done at this time through the button at the right.

You may come back to this site at a later time to register, or you may obtain a form to register the withdrawal by contacting Andrew LeBaron at 517-241-1435, or on-line at: www.michigan.gov/deqwateruse

Actions:

Help
Rerun
Register Now
Feedback
Print Report
Exit

DISCLAIMER:
The Water Withdrawal Assessment Tool is designed to estimate the likely impact of a proposed water withdrawal on nearby streams. It is not an indication of how much groundwater may be available for your use. The quantity and quality of groundwater varies greatly with depth and location. You should consult with a water resources professional or a local well driller about

Done | Internet | 100%

Development of WWAT

- Compact and Michigan Legislation provided the need to define adverse resource impact
- Science provided the context within which to define “adverse”
- State government made policy definition of “adverse”
- Water Resource Conservation Advisory Council provided a collaborative context for policy makers and scientists to iteratively inform each other

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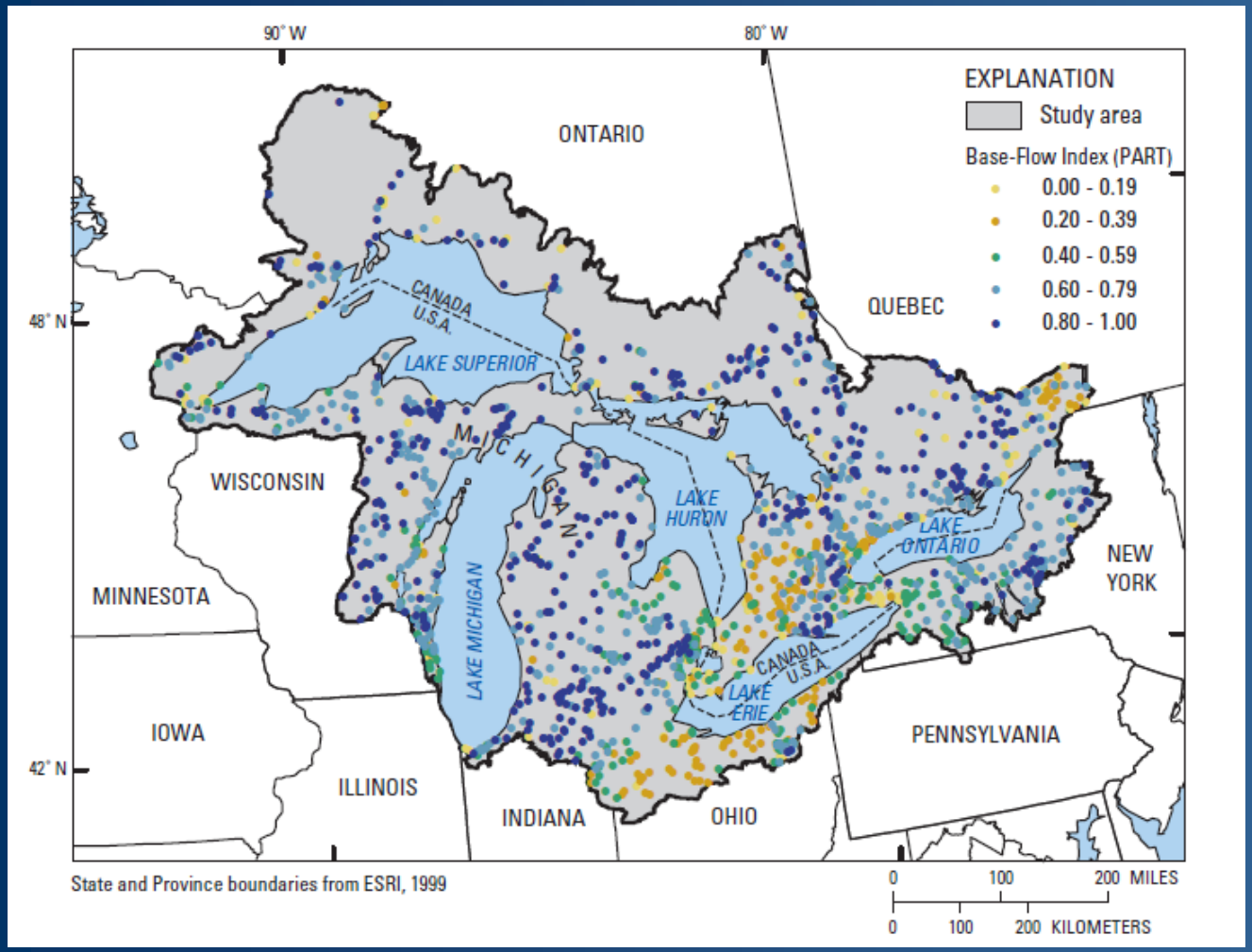
Application of WWAT

- Screens “in” proposed withdrawals that will not cause ARIs
- Provides information that can be used for site-specific review
- Provides context for cumulative impacts, since each valley segment has a defined amount of water available in perpetuity

USGS

Great Lakes Restoration Initiative



- Flow
- Withdrawal
- Fish
- Require State input for stream classification
- Flexible to accept State options
- Framework for application of ELOHA

USGS

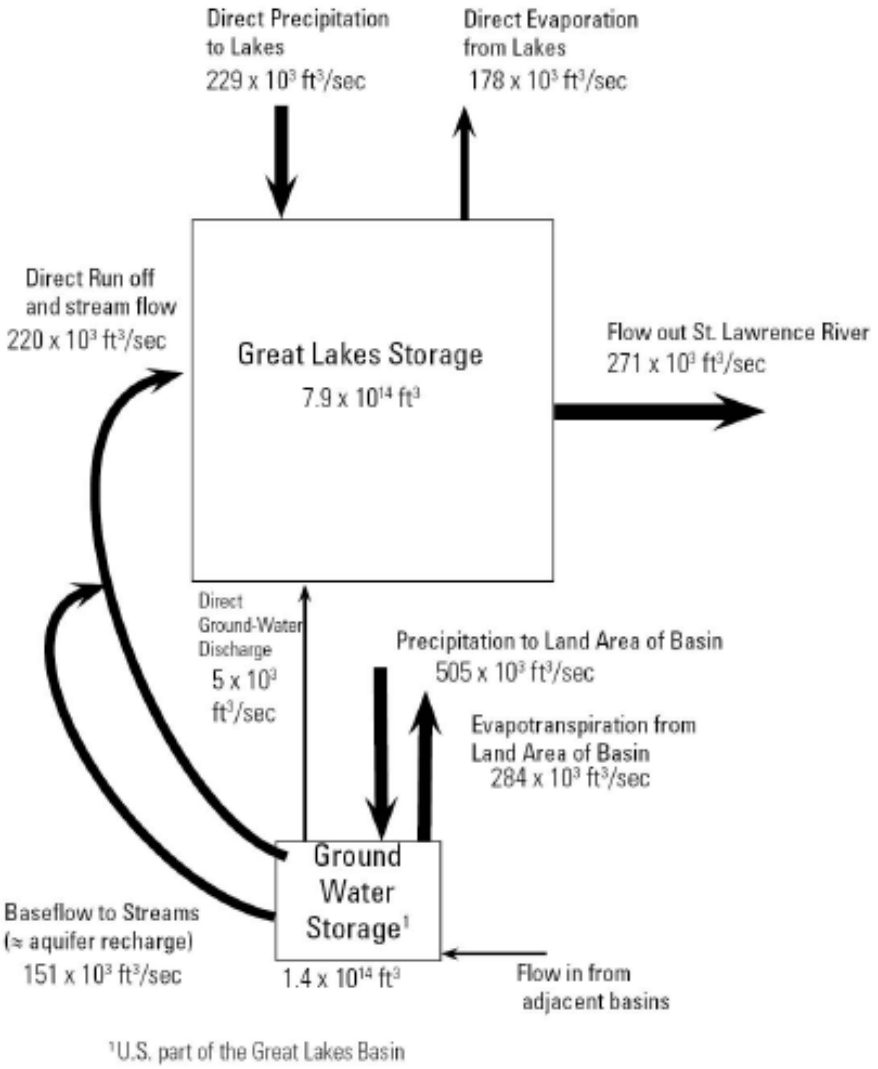
Neff and others, 2005

Acknowledgements

- Paul Seelbach, USGS (formerly MDNR)
- Dave Hamilton, MDNRE
- Howard Reeves, USGS
- Jeremiah Asher, MSU-IWR
- Michigan Legislature
- WRCAC
- http://www.miwwat.org/
- Includes links to publications

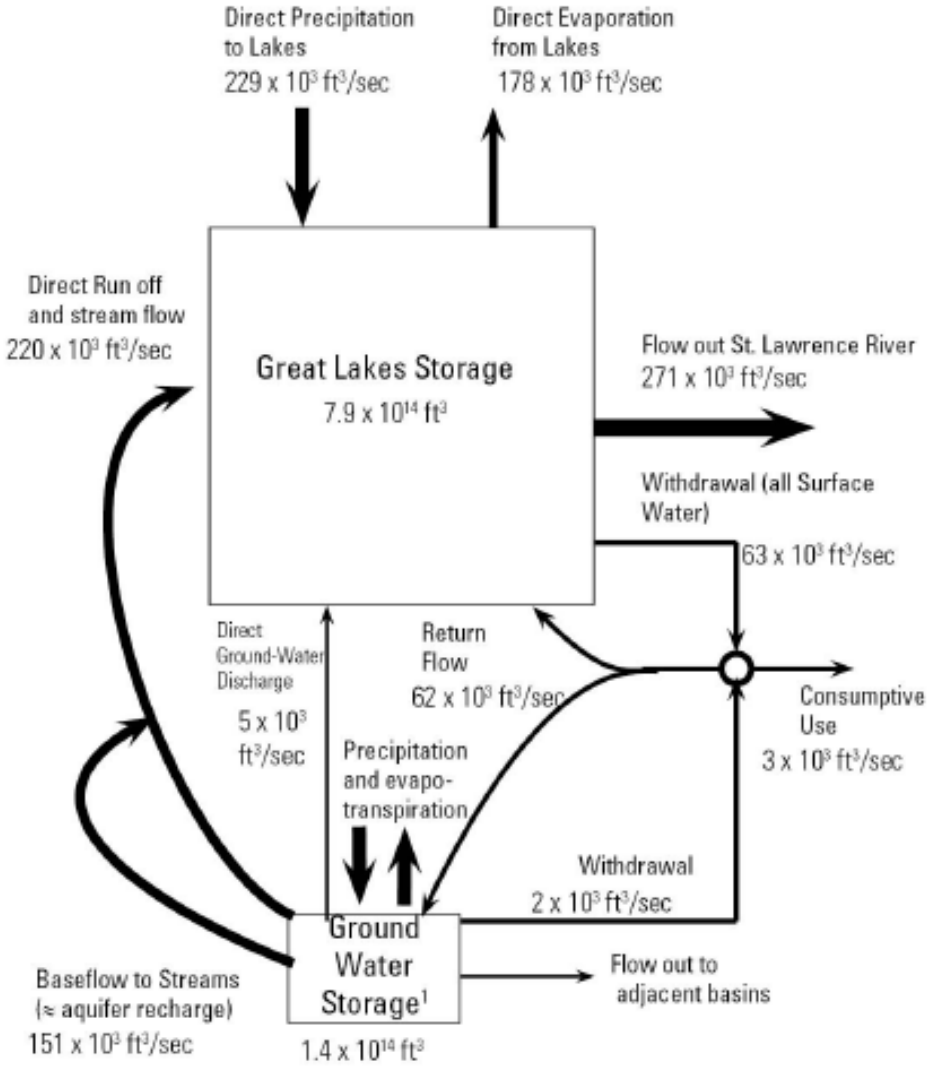
USGS

Predevelopment Regional Water Budget



¹U.S. part of the Great Lakes Basin

Developed Regional Water Budget



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